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A NEW FLYING LIZARD FROM THE SANGIHE ARCHIPELAGO, INDONESIA

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ABSTRACT. A new species of *Draco*, characterized by small size (to 75 mm SVL), reduced sexual dimorphism, somber coloration, five ribs in patagium, and eight to ten postrostrals, is described from Pulau Biaro, southernmost isle of Kepulauan Sangihe, ca 60 km north of the northeast tip of Minahasa, Sulawesi Utara.

Spanning some 450 km between Sulawesi and Mindanao, forming the northwestern limit of the Molucca Sea, are more than 40 islands on 15 submarine banks. Those closest to Sulawesi are named for their largest member: Kepulauan Sangihe—the Sangihe Archipelago. The southernmost of these, some 60 km northeast of Ponto do Celebres, and about 25 km from the next nearest land (Ruang), is the isle of Biaro. Like its sisters, Biaro is of volcanic origin. I suspect it arose just where we find it today, did not drift there from somewhere else, and has never had any terrestrial connection to any other land area.

The flying lizards, genus *Draco*, recently have been reviewed by Musters (1983) and Inger (1983). Their views are disparate. Only Musters admits *Draco* in the Sangihe Archipelago. He says *D. volans boschmai* is “perhaps on the Kepulauan Sangihe.” He examined no specimens from these islands and only one *volans* from Sulawesi (that from Macassar in the extreme southwest).

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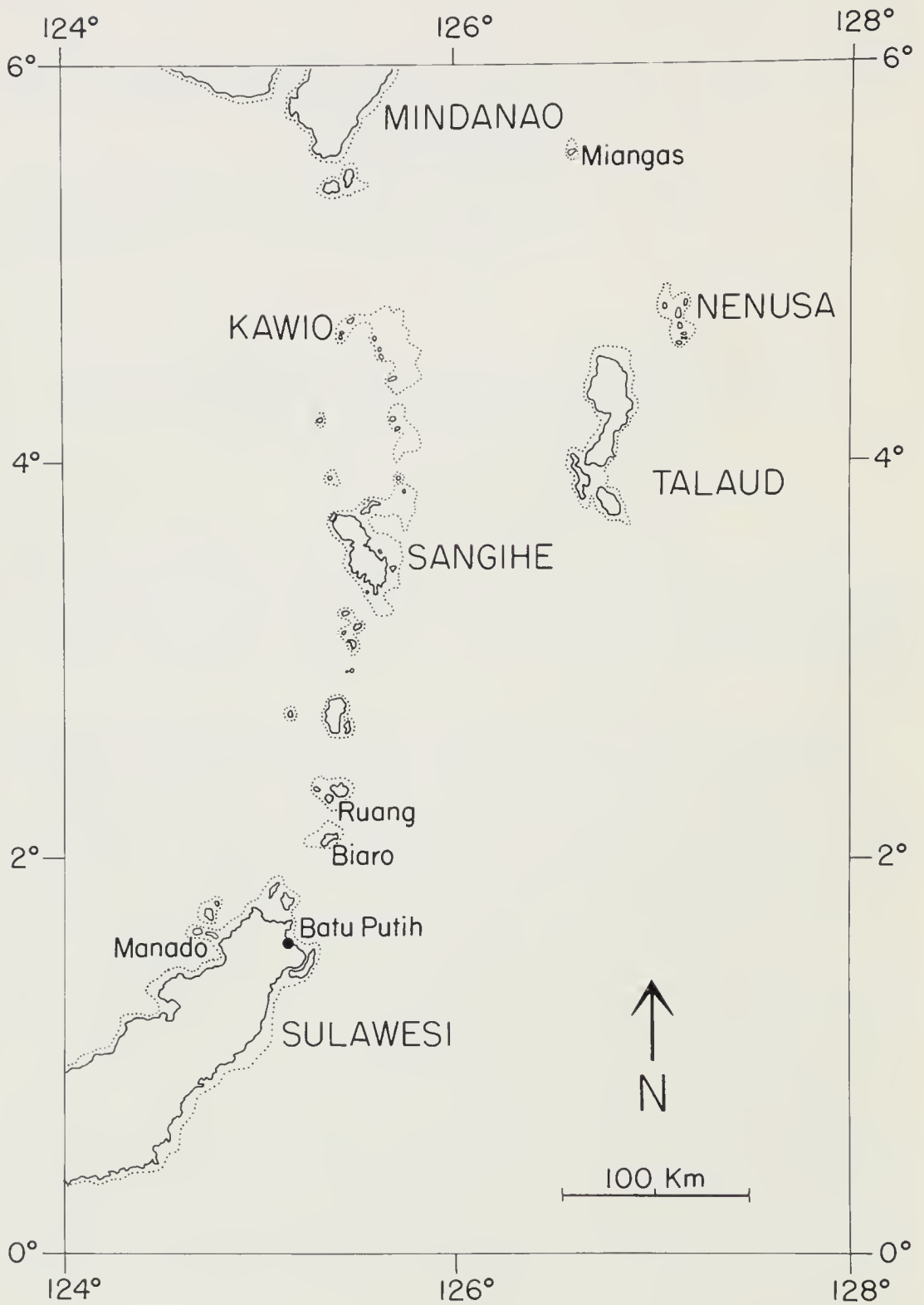


Figure 1. The northwestern Molucca Sea showing the islands and banks (200 meter depth) and the locations of places mentioned in the text.

After carefully studying both papers and examining many specimens at the Museum of Comparative Zoology, I conclude that our knowledge of *Draco* today is similar to our knowledge of *Anolis* in 1950. Nevertheless, I have returned from Biaro with 22 specimens of a *Draco* so distinctive that I have no hesitation in describing it as new.

Draco biaro sp. nov.
(Fig. 2)

Type. MCZ 170898.

Type Locality. Pulau Biaro, Kepulauan Sangihe, Indonesia. Bernard F. Page coll., 4 April 1986. See Figure 1.

Paratypes. MCZ 170899–170919, same locality as the type; B. Page, J. Lazell, and local children coll., 4 April 1986.

Diagnosis. A small species of *Draco*, adults to 75 mm SVL; five ribs in patagium; nostrils pointing laterally; most (90%) with small scales covering tympanum; four or five incisors (Inger's method); six to eight supralabials (73% have seven); eight to ten scales bordering rostral (64% have nine); male throat fan small, 55 to 82% of head length (Musters' method) in adult males; coloration in life of both sexes somber, patagium sooty to slaty grey above with 15 to 20 sublongitudinal to subradiate narrow light grey streaks.

Description of the Type. Adult male, 73 mm SVL, with a complete tail 145 mm (199% SVL). There are eight weakly keeled supralabials and nine scales border the rostral. The tympanum is clothed in small scales. The throat fan is 71% of head length, hooked distally, and blunt at the tip. See Figure 2.

The dorsals are smooth to weakly keeled; there are 15 in the standard distance (tip of snout to center of eye) at midbody. The ventrals are sharply keeled; there are 16 in the standard distance at midbody. There are 27 subdigital lamellae beneath the fourth toe of the pes, counting from that toe's separation from the third toe.

There are no thornlike supraciliaries although a few anterior supraciliaries are enlarged and keeled. The Y-shaped arrangement of keeled snout scales is interrupted and only vaguely discernible. The lappets are edged by somewhat enlarged scales, but the throat



Figure 2. *Draco biaro* sp. nov., The type: MCZ 170898, from the island of Biaro, Sangihe Archipelago, Sulawesi Utara, Indonesia.

fan bears only small ones. The caudal scales are subequal; there is no caudal crest. A low nuchal crest consists of about 22 enlarged, tectiform middorsals. The adpressed hindlimb just reaches the forelimb insertion.

Teeth were not counted in this specimen because the number is inconsequential in relevant species and opening the mouth may entail damage.

In life the type was largely grey. There was a beige-tan wash on the cheeks and jowls where the pattern was of irregular mottling. There are two bold, sooty nuchal blotches; between and flanking these is strongly contrasting pale ash-grey, making a roughly H-shaped figure, viewed from above. The dorsum is irregularly banded with light and dark grey in a lichenate pattern. The chest was washed with dull yellow. The throat fan was pale lemon-

yellow—almost white—with light grey barring. The dorsal surface of the patagium was sooty to slaty grey with a series of narrow ash-grey lines. The translucent, membranous skin of the flanks and ventral surfaces of the patagia looked light greenish with the patagia folded; this results from a pale bluish ventrolateral wash shading to pale yellow distally. When the patagia are expanded the dark dorsal color dominates, especially as sooty anterolateral blotches. The lappets were dull grey above, paler and yellowish grey below.

Variation. The sexes are quite similar. Six adult males measured 70 to 75 mm; seven adult females measured 71 to 75 mm; both sexes averaged 73 mm SVL. Eight of these 13 adults show some degree of supralabial carination. There may be low, somewhat irregular ridges (e.g., MCZ 170912, a male) or prominent, strong keels (e.g., MCZ 170910, a female).

I elected to quantify trunk scale size by the standard distance count method used in iguanid work (e.g., Lazell, 1972). In *Draco biaro* the middorsals are juxtaposed, subimbricate, and smooth, keeled, or weakly tectiform; there are 12–17 (average 15) in the standard distance. The ventrals are always sharply keeled and fairly well-aligned in transverse rows; there are 14–21 (average 16) in the standard distance.

There are 26–29 (average 28) subdigital lamellae on the fourth toe of the pes, distal to its separation from the third toe.

I could detect no sexual dimorphism in any mensurable or meristic characters.

Twenty specimens of *Draco biaro* have small scales, arranged in a whorl, over the tympanum. Two depart from this norm: MCZ 170899 has large scales over the tympanum. In MCZ 170919 the condition seems intermediate between a large scale and the thin, smooth skin of a typical tympanic membrane.

All specimens were very similar to the type in coloration in life. Females show little of the beige-tan wash on cheeks and jowls. Females have very small, unmarked grey throat fans, but the lappets are like those described for the male. The patagia of both sexes are similar. Juveniles tend to have a more strongly contrasting lichenate dorsal pattern in shades of grey than do large adults.

Inger and Musters concur that *Draco* of both the *lineatus* and

volans complexes have four or five incisiform teeth. Musters subtracts two from the total between the caniforms to approximate real incisors while Inger gives the total count; I used Inger's method because I cannot readily see which teeth are actually socketed in the premaxillaries. I checked five paratypes of *Draco biaro*, MCZ 170913–17. Only MCZ 170914 lacks a median tooth or socket and really seems to have four teeth. MCZ 170917 has four teeth, one median, and one empty socket. MCZ 170915 has only three teeth, one median, and at least one empty socket. Five is probably the normal count for the species.

Comparisons. In the key provided by Musters (1983), *Draco biaro* goes to the *D. lineatus* complex. Both Musters and Inger (1983) agree that *D. volans* normally has six ribs in the patagium, a number not seen in any *D. biaro*. A close reading of both texts renders the case more equivocal, however. There seems to be no absolute distinction between these nominal, polytypic species. Diagnoses are compromised by the great variation exhibited within both the *lineatus* and *volans* assemblages.

In Table 1 I list some characters used by either Musters or Inger, or both, in diagnoses. My caveat is that many of the given character states are not absolute. Species recognition in *Draco* may well depend on finer grained analyses, including extensive knowledge of coloration in life, and field knowledge of ecology and behavior. This sort of knowledge helped Inger (1983: 8–15) separate *D. maximus* and *D. quinquefasciatus* at Nanga Telakit, Sarawak.

On 28–29 April, 1986, I collected two series of *Draco* near Batu Putih in northeastern Minahasa, Sulawesi Utara. This locality is about 36 km northeast of Manado, type-locality of *Draco lineatus spilonotus* (taxonomy agreed by all workers). Batu Putih is about 60 km south of Biaro. Field knowledge and fresh specimens from Minahasa made me sure I was seeing a new species on Biaro.

Because the Minahasa series differs from key characters given by Musters (1983:34), and because coloration in life is so rarely known (in proportion to its probable extreme value in species recognition), I provide a brief description of *D. l. spilonotus* here.

My series, MCZ 170922–933, includes five adult males, four adult females, and three juveniles. There is striking sexual dimorphism. The largest female is 72 mm (MCZ 170930), the larg-

Table 1. Seven ways in which species of *Draco* from Sulawesi differ.

	<i>volans</i>	<i>lineatus</i>	<i>biaro</i>
Ribs	6	5	5
Snout Y	yes	yes	no
Thorn	distinct	weak	absent
Postrostrals	4–6	5–7	8–10
Hindlimb	no	yes	yes
Tympanum	skin	scales	variable
Size	96	91	75

Ribs are those within and supporting the patagium. The snout Y is composed of continuous, enlarged, keeled scales. The thorn is an enlarged, pointed, anterior supraciliary. Postrostrals are the small scales in contact with the rostral, counting the first supralabials. The hindlimb is addressed to determine if it is as long as the distance to the forelimb insertion (“yes”) or not (“no”). The tympanum may be covered with undifferentiated small scales or smooth skin (see text). Size is maximum snout-vent length (SVL); the number is for a female in both *lineatus* and *volans*, but in *biaro* the sexes are equal. Size varies geographically in both wide-ranging species.

est male 64 mm (MCZ 170925) snout to vent. The male throat fan is relatively long, 96 to 102% (average 99) of head length; it is nearly triangular, gradually tapering, and acutely pointed.

The males are brilliantly colored. The entire head and neck region is boldly spotted and marbled with chartreuse, aquamarine, and copper-tarnish green on an olive-beige ground. On the trunk this ground color is marbled with grey. The patagia are bright salmon pink, orange, or orange-yellow. The belly is green. Both lappets and throat fan vary from brilliant lemon to sulfur yellow.

The females are darker and duller. The head and neck mottling is in shades of olive green and olive brown. The patagia are deep rich yellow or orange-yellow spotted or barred with near black. The lappets and throat are light yellow. Both sexes have some power of color change, to lighter or darker. This change does not seem to affect the patagia, lappets, or throat fan.

My specimens differ most notably from those described by Musters (1983) in patterning of the head and neck. They have retained their bold patterns in alcohol (three months at time of writing), though the bright colors have faded. The significance of the differences cannot be judged without far more extensive knowledge of populations in life.

I have examined six specimens of *Draco lineatus bimaculatus*, MCZ 26178–82 and 43640, from Mindanao. In these the rostral is tiny compared to that of *D. biaro*. The eye is roofed by large, plate-like, keeled supraciliaries. The enlarged, aligned, keeled scales on the frontal region form an arrow-shaped pattern, not a Y. There are 10 to 12 supralabials (60% have 11). A more cursory look at all other Philippines material in MCZ further convinces me that the relationships of *Draco biaro* do not lie with known *Draco* from that area.

On balance, the affinities of *D. biaro* seem to lie with the *lineatus* complex not the *volans* group. I predict the discovery of many more island forms in the Sangihe, Kawio, Nenusa, and Talaud archipelagos between Sulawesi and Mindanao.

Comments. *Draco biaro* is common on its small island, frequenting coconut palms and other smooth-barked trees. Most were encountered two to four meters from the ground and noosed with a long pole. Often they fled up the trunks and children climbed after them. They sometimes ascended more than 20 meters. Eventually, when pursued, they would launch and glide. Then one could observe two large, middle-aged men and several dozen children racing through the grass and brush after the flying lizard, which sometimes landed low enough to be caught by hand.

Courtship was often observed. The male rapidly extends the throat fan and lappets several times and then fans the patagia. Most adult females palpably contain eggs. Two eggs, MCZ 170920–21, were laid in a collecting bag with several females during the hours between capture and pickling. One egg was broken, but MCZ 170920 measures 14.7 by 7.8 mm. It is white and leathery.

Pulau Biaro is subtended to the south by at least one small coastal cay. Coconut palms and other trees grow on this cay, but I did not visit it. *Draco biaro* may occur there.

Six other species of reptiles were collected on Biaro on 4 April: the vine snake *Ahaetulla prasina*, the skinks *Mabuya multifasciata* and *Lamprolepis smaragdinus*, and three geckos. *Hemidactylus frenatus* and *Gehyra mutilata* are abundant Indo-Pacific human commensals. *Gymnodactylus jellesmae* is rare in collections and seems to have been previously known only from Sulawesi.

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